

CLAIMS

What is claimed is:

- 1 1. A magnetic head having a pinned area, a free area, and a nanoconstricted area
2 encompassing portions of the pinned and free areas, the head comprising:
3 a first layer of magnetic material extending along the pinned and free areas;
4 an AP coupling layer extending along the pinned area; and
5 a third layer of magnetic material, an active portion of the third layer extending
6 along the pinned area but not along the free area;
7 wherein the first and third layers have magnetic moments that are self-pinned
8 antiparallel to each other in the pinned area and a portion of the
9 nanoconstricted area encompassing the pinned area.

- 1 2. A head as recited in claim 1, wherein a height of the nanoconstricted area is less
2 than about 100 nanometers.

- 1 3. A head as recited in claim 1, wherein a height of the nanoconstricted area is less
2 than about 50 nanometers.

- 1 4. A head as recited in claim 1, wherein a height of the nanoconstricted area is about
2 10 to 30 nanometers.

- 1 5. A head as recited in claim 1, wherein the third layer has been removed from the
2 free area by at least one of etching and milling.
- 1 6. A head as recited in claim 1, wherein a portion of the third layer in the free area
2 has been rendered nonmagnetic.
- 1 7. A head as recited in claim 6, wherein the portion of the third layer in the free area
2 has been rendered nonmagnetic by oxidation.
- 1 8. A head as recited in claim 1, further comprising a hard bias layer positioned
2 outside the free area for stabilizing the first layer in the free area.
- 1 9. A head as recited in claim 1, wherein the first layer includes NiFe.
- 1 10. A head as recited in claim 1, wherein the third layer includes CoFe.
- 1 11. A head as recited in claim 1, wherein the AP coupling layer includes Ru.
- 1 12. A magnetic head having a pinned area, a free area, and a nanoconstricted area
2 encompassing a portion of the free area and a greater portion of the pinned area,
3 the head comprising:
4 a first layer of magnetic material extending along the pinned and free areas;
5 an AP coupling layer extending along the pinned area; and

6 a third layer of magnetic material extending along the pinned area but not into the
7 free area;
8 wherein the first and third layers have magnetic moments that are self-pinned
9 antiparallel to each other in the pinned area and the nanoconstricted area.

1 13. A head as recited in claim 12, wherein a height of the nanoconstricted area is less
2 than about 100 nanometers.

1 14. A head as recited in claim 12, wherein a height of the nanoconstricted area is less
2 than about 50 nanometers.

1 15. A head as recited in claim 12, wherein a height of the nanoconstricted area is
2 about 10 to 30 nanometers.

1 16. A head as recited in claim 12, wherein the third layer has been removed from the
2 free area by at least one of etching and milling.

1 17. A head as recited in claim 12, wherein a portion of the third layer in the free area
2 has been rendered nonmagnetic.

1 18. A head as recited in claim 17, wherein the portion of the third layer in the free
2 area has been rendered nonmagnetic by oxidation.

- 1 19. A head as recited in claim 12, wherein the first layer includes NiFe.
- 1 20. A head as recited in claim 12, wherein the third layer includes CoFe.
- 1 21. A head as recited in claim 12, wherein the AP coupling layer includes Ru.
- 1 22. A magnetic head having a pinned area, a free area, and a nanoconstricted area
2 encompassing a portion of the pinned area and a greater portion of the free area,
3 the head comprising:
4 a first layer of magnetic material extending along the pinned and free areas;
5 an AP coupling layer extending along the pinned area; and
6 a third layer of magnetic material extending along the pinned area but not into the
7 free area;
8 wherein the first and third layers have magnetic moments that are self-pinned
9 antiparallel to each other in the pinned area.
- 1 23. A head as recited in claim 22, wherein a height of the nanoconstricted area is less
2 than about 100 nanometers.
- 1 24. A head as recited in claim 22, wherein a height of the nanoconstricted area is less
2 than about 50 nanometers.

- 1 25. A head as recited in claim 22, wherein a height of the nanoconstricted area is
2 about 10 to 30 nanometers.
- 1 26. A head as recited in claim 22, wherein the third layer has been removed from the
2 free area by at least one of etching and milling.
- 1 27. A head as recited in claim 22, wherein a portion of the third layer in the free area
2 has been rendered nonmagnetic.
- 1 28. A head as recited in claim 27, wherein the portion of the third layer in the free
2 area has been rendered nonmagnetic by oxidation.
- 1 29. A head as recited in claim 22, wherein the first layer includes NiFe.
- 1 30. A head as recited in claim 22, wherein the third layer includes CoFe.
- 1 31. A head as recited in claim 22, wherein the AP coupling layer includes Ru.
- 1 32. A magnetic storage system, comprising:
2 magnetic media;
3 at least one head for reading from and writing to the magnetic media, each head
4 having:
5 a sensing element having the structure recited in claim 1;

- 6 a write element coupled to the sensor;
- 7 a slider for supporting the head; and
- 8 a control unit coupled to the head for controlling operation of the head.